

Case report

Acute unintentional intoxication with paraffin in a 25-year old patient – Clinical case report



Andon Chibishev*, Natasa Simonovska

University Clinic for Toxicology and Urgent Internal Medicine, Ul. Vodnjanska 17, Skopje, Former Yugoslav Republic of Macedonia, The

ARTICLE INFO

Article history:

Received 10 May 2013

Received in revised form

26 February 2014

Accepted 25 April 2014

Available online 10 May 2014

Keywords:

Fire-breathing

Intoxication

Paraffin

ABSTRACT

"Fire-breathing" or "fire-eating" is a special kind of street art where the acts are always stunning, spectacular and amazing. People exhibiting this kind of show are professionals, not rare amateurs, who use different kind of fuels, usually hydrocarbons, in order to produce a pillar of fire. Intoxications caused by ingestion or inhalation of liquid paraffin, used as a fuel while performing, are numerous and various. We present a clinical case report of a 25-year old, previously healthy, amateur "fire-breather". During October, 2010 this young men arrived at the Emergency Unit of the University Clinic for toxicology and Urgent Internal Medicine in a severe clinical condition, after his unsuccessful attempt to perform real "fire-breathing". He had fever, strong headaches, mild abdominal and chest pain and he also had difficulties breathing and persistent dry cough. The patient was extremely dyspneic with peripheral cyanosis and shortness of breath.

"Fire-breathers" must be viewed as a population at risk of paraffin-induced pneumonia, which has low mortality rate, but still is related with numerous and various chronic complications. Our patient was first in a life threatening, extremely serious clinical condition which was urgently treated with appropriate vigorous and effective therapy. This therapeutic protocol led to successful full recovery of these young men, who luckily didn't exhibit any chronic complications.

© 2014 Elsevier Ltd and Faculty of Forensic and Legal Medicine. All rights reserved.

1. Introduction

"Fire-breathing" or "fire-eating" is a special kind of street art where the acts are always stunning, spectacular and amazing. There are different words describing this particular art including blowing, aspirating and spitting. "Fire-breathers" are street performers who usually practice extensively to demonstrate this magnificent show. To produce a pillar of fire they use two components: fuel and a flame source, which at the start sounds and looks very simple, but controlling the fuel's direction and consistency is a technique that requires a lot of time to improve. Performers use different kind of chemical substances as a fuel, but most often they utilize a hydrocarbon known as kerosene. It is a petroleum distillate, also known as liquid paraffin and it can be found on the market under its commercial name "liquid wax". Intoxications caused by ingestion or inhalation of liquid paraffin, used as a fuel while performing, are numerous and various. Usually we see different kinds of burns,

skin irritation, stomach ulcers and gum diseases. But the condition that performers are quite prone to is a clinical entity called hydrocarbon pneumonitis, also known as "fire-breathers or fire-eaters lipid pneumonia", which can often lead to acute respiratory distress and several severe respiratory complications.^{1,2} Initial symptoms usually include fever, chest pain, dry cough, shortness of breath with unilateral or bilateral nonspecific alveolar infiltrates manifesting on plain chest radiographs.³

We report about a rare case of an amateur fire-breather who tried to perform a fire-breathing show without any previous experience.

2. Case report history

Our patient is a very adventurous, healthy 25-year old male student. One night, in the late hours, during October 2010, he was admitted to the Emergency Unit at the Clinic of Toxicology and Urgent Internal Medicine, after his unsuccessful attempt to perform a real "fire-breathing" or "fire-blowing" act. During his performance he used paraffin oil, also known as kerosene, as a fuel, which is a flammable, volatile and toxic substance. After putting some

* Corresponding author. Tel.: +389 75303630.

E-mail addresses: toksikourgentna@gmail.com (A. Chibishev), n.simonovska@yahoo.com (N. Simonovska).

quantity of the fuel in his mouth he immediately tried to blow it in a pillar of fire, but during the event he unknowingly, inadvertently and unintentionally swallowed and aspirated a small amount of it. He did not have any immediate symptoms following this accident, so he felt quite well for a while. Unfortunately, two days after he got fever, felt mild abdominal and strict chest pain, with difficult breathing and dry cough. When he arrived at our emergency unit initially he complained on strong headaches, dizziness and persistent dry cough with hemoptysis. He was febrile (38.9°C), extremely dyspneic with peripheral cyanosis and shortness of breath. We immediately put him on an intensive care monitor which measured blood pressure of $130/65\text{ mmHg}$ and heart rate of 75 bpm . He was conscious, contactable and well orientated. On inspection his chest was normosthenic and symmetrical. Despite the severe pain, he could move his chest with regular and balanced respirations. Immediate pulmonary auscultation revealed rhonchi over the lower, basal part of the left lung and bilateral basal rales.

Laboratory test on admission showed normal findings despite the leucocytosis (Neu: 92.6%) and hyperglycemia. Also we measured fibrin degradation products and they showed secondary activated fibrinolysis (1917 ng/ml). His blood gas analysis showed hypoxia with partial respiratory insufficiency. The patient was hospitalized at the Intensive care unit and he was put on a continuous oxygen-therapy on mask. After installing an intravenous line we first administrated pain relievers, antipyretics and bronchodilatators. Due to the severe clinical condition and suspected pulmonary thromboembolism we asked for an urgent chest X-ray. It revealed bilateral perihilar and basal infiltrates with low transparency. The heart was normal and there were no pleural effusions (Fig. 1).

His initial treatment consisted of:

- Continuous oxygenotherapy on mask.
- Intravenous fluids (NaCl-0.9% 1000 ml/12 h).
- Double antibiotic therapy (2 g of ceftiaxon + 800 mg of ciprofloxacin/24 h in the first five days, after that we added 1500 mg of metronidasole/24 h with excluding ciprofloxacin from the therapy).
- Corticosteroids (8 mg of dexamethasone/24 h).
- Bronchodilatators (500 mg of aminophyline).
- Vitamin K (10 mg fitonadione).
- Anticoagulant (40 mg of enoxiparine/24 h).
- Ranitidine 300 mg.
- Vitamins.

This therapy was administered parenterally during the first 10 days. After that the patient continued receiving these drugs by mouth, for 15 days.

Because the diagnosis remained unclear we continued with extensive diagnostic procedures to maintain the right diagnosis. Electrocardiography examination showed a typical pattern of a right bundle branch block (RBBB). Echocardiography (heart ultrasound) revealed a mild reduction of left ventricular function, mild mitral regurgitation and paradoxical septal motion, due to the RBBB. The abdominal ultrasound was with normal findings. He also told us that during the accident he swallowed some amount of the fuel and that he felt abdominal discomfort for the whole time, so we also wanted to examine the condition of the upper gastrointestinal tract with upper endoscopy (esophagogastroduodenoscopy), with a flexible endoscope. We found a superficial erosions in the lower esophagus and gastric cardia; some superficial, narrow erosions in the antropyloric and posterior regions of the stomach and various duodenal lesions. His hemoculture was sterile. At the same time, during the next three days, the patients' condition worsened and he was in a very critical condition. He continued receiving the same aggressive therapy protocol, in which we added antacids and protein pump inhibitors to protect the gastrointestinal mucosa. When 10 days passed he exhibited slightly improvement in his clinical condition. Control chest X-ray, which was made 10 days after commencement of treatment, showed bilateral basal consolidations of the pulmonary parenchyma, with pleural adhesions on the left. The heart shadow remained normal (Fig. 2).

The patient received corticosteroid therapy for 15 days and it was reduced day by day; 8 mg of dexamethasone were given during the first 10 days and after that during 3 days we continued with 4 mg of dexamethasone and finished with 2 mg od dexamethasone during the last 2 days.

On the 17th day he was in a good condition so he was transferred to a regular stationary ward.

Where we continued with oral antibiotics, intravenous fluids and vitaminotherapy. Luckily, after 4 weeks the patient was fully recovered and he left our clinic in a good and improved clinical condition. Due to the seriousness of the intoxication this patient was monitored in the next three months and was found to be in an excellent condition. A final X-ray performed 5 months later showed complete regression of the pulmonary changes.

The diagnosis of this patient was acute aspiration pneumonia, known as "fire-breathing" pneumonia, or also found in the literature under the name "fire-eaters" lung or "fire-eaters" lung irritation. Of the main importance is the fact that completion of right diagnosis was a little delayed because aspiration history was not shown by the patient from the first moment. We reached the diagnosis after identifying the chemical agent used as a "fuel", with detection of its chemical structure and possible toxic effects and also detecting organic damages that it caused in the patient.

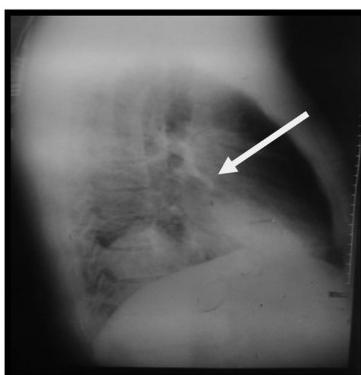
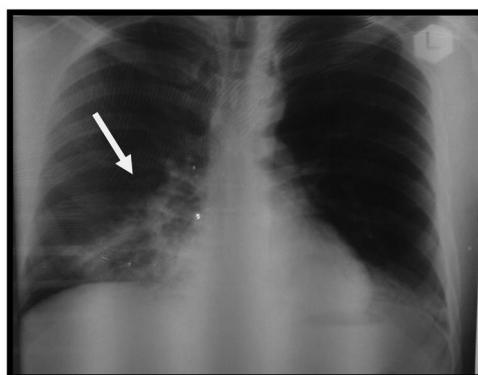


Fig. 1. Chest X-ray on admission (Areas marked with arrows show basal and perihilar infiltrates with low transparency).

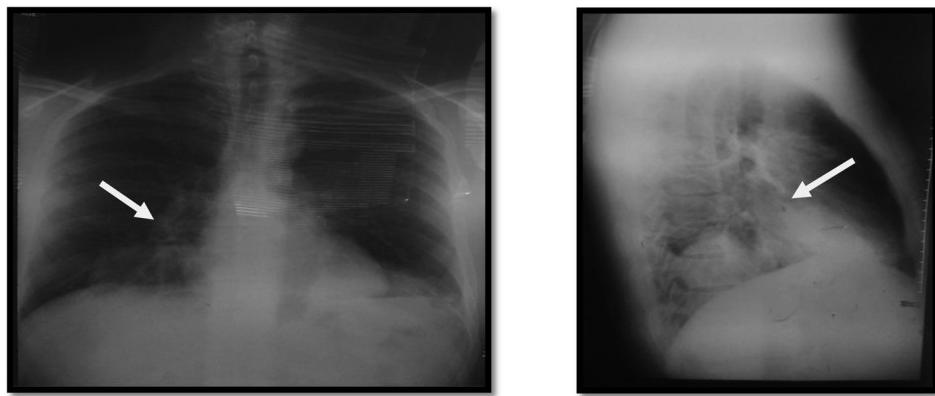


Fig. 2. Chest X-ray after 10 day (Areas marked with arrows show improved X-ray findings).

3. Discussion

Hydrocarbons are a heterogeneous group of organic substances, primarily composed of carbon and hydrogen molecules, quite abundant in the modern society, used for medical, as well as domestic purposes. Some of the most commonly ingested hydrocarbons include gasoline, motor oil, kerosene, lighter fluid or naphtha. They can be derived from either petroleum or wood. Hydrocarbon toxicity is directly related to their physical properties such as viscosity, volatility, surface tension and chemical activity of the side chains. Hydrocarbons have a numerous destructive effects on the human body. Target organs which are usually involved and destroyed after intoxication with hydrocarbons are lungs, central nervous system, heart, kidneys and skin, but the most commonly involved system is the pulmonary system. Consequently, the most frequently reported adverse effects affect the pulmonary complications following aspiration.^{2,4}

Liquid paraffin has high flash point, it is smoky and has a very noticeable smell when burning.⁵ Aspiration of liquid paraffin causes specific type of pneumonia with its direct toxic effects on the lung parenchyma. Specifically it destroys type II pneumocytes and leads to decreased surfactant production, alveolar collapse, ventilation-perfusion mismatch and hypoxemia. In some cases we can see pulmonary complications such as interstitial inflammation, intra-alveolar hemorrhage, edema, bronchial necrosis and vascular necrosis ensue. On the other hand pneumothorax, pneumatocele or bronchopleural fistula are among the rare complications.^{5–7}

According to the American Association of Poison Control Centers' in USA, during 2009, 43,410 cases of hydrocarbon poisoning were reported to US poison control centers. Of these, more than 26,126 were patients aged 19 years or younger. In 2009, 9 deaths due to hydrocarbon intoxication were reported to US poison control centers, but investigators believe that the true number of poisonings is probably slightly higher. However, several other deaths are classified as being due to "chemicals, cleaning substances, fumes/gases/vaporizers", and "pesticides". In addition, the poison control data are widely known to be an underestimate of the true incidence because of underreporting. Inhalant abuse of hydrocarbons is becoming increasingly common among adolescents. In USA, it is estimated that approximately 20% of students in middle school and high school have abused volatile substances. Accidental aspiration of hydrocarbons is also more common among children. In the General Hospital, Port-Gentil (Gabon), Service of pediatrics, they reported 36 cases of acute intoxications with petroleum in children. They advised that a great emphasis should be put on the prevention of such incidents with a wider public health education.^{4,8,9}

A numerous and various cases, very similar to ours, were found among the literature, explaining different accidents, most often in street performers. They report a range of clinical features, diagnostic findings, and usage of different treatments. With them we can also compare progression of the clinical condition in patients and also time frame needed for their improvement.

A case report of "fire-breathers" aspiration pneumonia was shown in Italy, where the patient developed fever, dyspnea, progressive cough and chest pain six hours after the accident. The acute stage of the intoxication lasted 4 weeks. He was treated with antibiotics, antipyretics and corticosteroids and the treatment showed quite good results with full recovery of the patients' condition within three months.¹⁰ In Turkey they reported two cases of accidental aspiration of liquid hydrocarbon-based fuel, during a "fire-breathing" performance. They were admitted to hospital with chest pain, shortness of breath, fever and cough; findings were similar to any infectious pneumonia.¹¹ Also two very similar cases were shown in the Netherlands. They called the condition "fire-eater aspiration pneumonitis" or "fire-eater lung". Both patients were successfully treated with antibiotics and recovered after a several days. It is of a great importance that following aspirations of petroleum there can be a period of latency before any symptom occurs, which apostrophize the need of full, close and intensive monitoring of patients.¹²

"Fire-breather's pneumonia" caused by an accidental aspiration of hydrocarbons is actually a lipoid pneumonia which results from accumulation of exogenous lipids. Its symptoms vary significantly, from asymptomatic to severe disease, but still the disease is quite indolent. This kind of pneumonia manifests on radiologic studies with nonspecific patterns, usually unilateral or bilateral lung consolidations, and for this reason it can mimic numerous other conditions. On the other hand CT findings are most characteristic, with a presence of negative attenuation values within areas of consolidation. In Spain they reported three cases with nonspecific X-ray findings, from which one patient developed a bronchopleural fistula and spontaneous pyopneumothorax. On the other hand in Turkey they reported a case of a fire-eater's pneumonia due to accidental aspiration of liquid paraffin where the most prominent radiologic finding was a pattern of multiple pneumatoceles.^{13–15}

A rare complication that can arise after an aspiration of vaporized kerosene and is also reported among literature is pneumonitis. It commonly occurs in children, but in France they reported six cases of chemical pneumonitis seen in adult patients, who were mainly hospitalized in large tourist areas that host many street festivals. Despite that petroleum aspiration is infrequent in German, a group of German authors reported one case of typical "fire-eaters pneumonitis". They report a case fatality rates of less

than 1%, but also they put an accent on the emergency medical support in treatment of hydrocarbon aspiration.^{16,17}

As stated earlier the treatment of fire-breathers' pneumonia is symptomatic. First, at the emergency unit, patients should receive continuous oxygen therapy until their saturation rises and they improve their condition. Corticosteroids should be administered regularly, especially in severe cases. Also antibiotics should be used both empirically to prevent infection and when the infection is declared as a complication. Usage of appropriate therapy results in a quick clinical recovery, with full improvement of the condition expected after a several weeks. In some patients restrictive respiratory diseases and reduced diffusion capacity have been described, despite the treatment. Nevertheless in all of them complete or nearly complete remission of radiological signs show be expected after the next 1–12 months.¹⁹

Establishment of right diagnosis in these cases is very complicated and tricky, so it is very important to mention that the list of differential diagnoses of "fire-eater's pneumonia" is much extended. A group of doctors in Czech Republic reported that it is impossible to make a diagnosis of this disease without clinical exploration; also that the patients' immediate past history plays an important role. There are many cases which remain undiagnosed, particularly in cases when past history of fire-eating is not known to the doctor. Clinical presentation can mimic a chest infection and pulmonary embolism, so the condition will remain undiagnosed until the clinical history was fully revealed to the treating doctor.¹⁸

4. Conclusion

Acute unintentional intoxications with liquid paraffin are very rare in our country. These kinds of intoxications, seen across the literature as a fire breathers' or fire-eaters' pneumonia, are almost always serious and life threatening at the beginning, and same as in our case, patients rapidly fall into a severe clinical condition. This condition, as we reported, needs to be treated urgently with appropriate effective therapy. Luckily the therapeutic protocol used in our case was very successful and it led to full recovery without any chronic complications. These poisonings are unspecific and patients' typical findings are similar to numerous other respiratory diseases. Establishment of diagnosis can be very difficult especially if very aspects of related history are not shown by the patient from the beginning.

Studying this type of intoxications is quite difficult and also limited due to small number of such cases reported across Europe and USA. In further investigations we should employ more professionals such as epidemiologists, medical statistics experts,

experts in occupational health and clinical toxicologists in order to detect these intoxications more often and to skip underreporting.

Ethical approval

None.

Funding

None.

Conflict of interest

None declared.

References

- Chilcott RP. *Kerosene; toxicological overview*. Health Protection Agency; CHAPD HQ, HPA; 2007. Version 2.
- Lifshitz M, Sofer S, Gorodischer R. Hydrocarbon poisoning in children: a 5-year retrospective study. *Wilderness Environ Med* 2003;14(2):78–82.
- Guandalini M, Steinke K. Fire eating: hazards of hydrocarbon aspiration. *Australas Radiol* 2007;51:567–9.
- Bronstein AC, Spyker DA, Cantilena Jr LR, et al. 2009 annual report of the American Association of Poison Control Centers' national poison data system (NPDS): 27th annual report. *Clin Toxicol (Phila)* Dec 2010;48(10):979–1178.
- Wilson VT. "How fire breathing works". HowStuffWorks.com; 30 August 2005. <<http://entertainment.howstuffworks.com/arts/circus-arts/fire-breathing.htm>>; 30 August 2005 [accessed 16.04.12].
- Gross P, Mcnerney JM, Babyak MA. Kerosene pneumonitis: an experimental study with small doses. *Am Rev Respir Dis* Nov 1963;88:656–63.
- Rodricks A, Satyanarayana M, D'Souza GA, Ramachandran P. Turpentine-induced chemical pneumonitis with broncho-pleural fistula. *J Assoc Physicians India* Jul 2003;51:729–30.
- Anderson CE, Loomis GA. Recognition and prevention of inhalant abuse. *Am Fam Physician* Sep 1 2003;68(5):869–74.
- Huber C, Huber-Braun MC, Desrentes M, Lautier F. Acute petroleum poisoning in infants in Gabon. *Bull Soc Pathol Exot Filiales* 1987;80(4):682–8.
- Vimercati L, Lorusso A, Bruno S, Carrus A, Cappello S, Belfiore A, et al. *G Ital Med Lav Ergon* 2006 Apr–Jun;28(2):226–8.
- Yigit O, Bektas F, Sayrac AV, Senay E. Fire-eater's pneumonia: two case reports of accidentally aspirated paraffin oil. *J Emerg Med* 2012 Apr;42(4):417–9.
- Harding FM, Hiddinga BI, Eijsvogel MM, van Baarlen J, Oosterhof-Berkatas R. *Ned Tijdschr Geneeskd* 2010;154(45):A2358.
- Marchiori E, Zanetti G, Mano CM, et al. Exogenous lipid pneumonia. Clinical and radiological manifestations. *Respir Med* 2011;105(5):659–66.
- Franquet T, Gomez-Santos D, Gimenez A, Torrubia S, Monill JM. Fire eater's pneumonia: radiographic and CT findings. *J Comput Assist Tomogr* 2000;24:448–50.
- Karacan O, Yilmaz I, Eyüboğlu FO. *Turk J Pediatr* 2006 Jan–Mar;48(1):85–8.
- Lamour C, Bouchaud C, Doré P, d'Arthac M, Bodin J. Pneumonitis caused by hydrocarbon inhalation. *Rev Mal Respir* 2003 Dec;20(6 Pt 1):959–64.
- Studer D, Brill AK, Joost C, Stucki A. *Praxis (Bern 1994)* 2012 Jun 6;101(12):793–8.
- Pielaszkiewicz-Wydra M, et al. Exogenous lipid pneumonia – a case report of a fire-eater. *Pol J Radiol* 2012 Oct–Dec;77(4):60–4.
- Bulava A, Kolek V, Lukl J. Fire-eater's pneumonia – a difficult differential diagnosis. *Cas Lek Cesk* 2001 Apr 26;140(8):242–5.